REMARKS

In view of the above amendments and following remarks, reexamination and reconsideration are respectfully requested.

By this Amendment, minor editorial amendments have been made to the specification so as to generally place the application in better condition. It is submitted that no new matter has been added.

Further by this Amendment, each of claims 1-2, 4-5, and 7-8 has been amended, and claims 9-12 have been newly added. It is submitted that claims 1-12 are currently pending in this application.

Regarding the Amendments to claims 1-2, 4-5, and 7-8, it is noted that the amendments made to each of these claims are minor editorial amendments which have been made so as to generally improve the clarity of the claims. It is particularly noted that these amendments do not narrow the scope of the claims and are not being made for reasons related to patenability.

Next, it is noted that the Examiner has rejected claims 1-8 under 35 U.S.C. § 103(a) as being unpatentable over Matsuda (JP-2000097786A) in view of Brownlow (USPN: 5,787,213) for the reasons contained in paragraph 2 on pages 2-4 of the Office Action.

The Applicant respectfully traverses the aforementioned rejection and submits that the present invention, at least as claimed in independent claim 1, clearly patentably distinguishes over the references relied upon by the Examiner for at least the following reasons.

Initially, the Applicants note that Claim 1 of the present application recites the following (reference numbers in bold inserted for reference purposes only)

> 1. A fiber Bragg grating strain sensor, said sensor comprising:
>
> a strain sensor member having a strain sensing section for receiving stress in a longitudinal direction; and
>
> **(1)** a fiber Bragg grating fastened to said strain sensor member within the strain

sensing section, having **(2)** a first end oriented in the longitudinal direction, a second end oriented in a lateral direction perpendicular to the longitudinal direction, and **(3)** a fiber axis describing one quarter of a circular arc between the first end and the second end.

For illustrative purposes, the Examiner is kindly requested to refer to Figure 7 of the present application. Regarding feature **(2)** above, as shown in Figure 7, a first end of the fiber Bragg grating 12 is oriented in a longitudinal direction (i.e., x-direction which is the direction of the stress) and second end of the fiber Bragg grating 12 is oriented in a lateral direction (i.e., y-direction) perpendicular to the longitudinal direction. Furthermore, a fiber axis α of the fiber Bragg grating 12 describes one quarter of a circular arc between the first end and the second end.

By providing the aforementioned features as claimed in the present application, the sensitivity according to the fiber Bragg grating strain sensor of present invention is able to achieve a sensitivity which exceeds the sensitivity of the conventional strain sensor by a factor of approximately 2.5 [see last paragraph of page 13 of the specification]. This significant sensitivity improvement over the prior art is detailed in actual tests performed as discussed on pages 9-13 of the specification. This significant improvement over prior art is obtained due the fact that the fiber Bragg grating according to the present invention follow an arc and, thus, the sensitivity depends on Poisson's ratio and is not limited by the sensor geometry as in the prior art, and is also due to the fact that by providing the aforementioned claimed arrangement **(1)-(3)** of the present invention, strain elongates one end of the fiber Bragg grating and compresses the other end [see lines 1-12 of page 14 of specification].

It is submitted that the above discussed features **(1)-(3)** of the present invention are encompassed within the limitations of independent claim 1 of the present application. Further, it is submitted that the above limitations, and the above advantages resultant therefrom, are not disclosed, suggested, or rendered obvious by any of the references cited by the Examiner taken either alone or in combination.

Particularly, it is noted that the Examiner has acknowledged, on page 3 of the Office Action, that, *"Matsuda does not disclose a fiber bragg grating having a second end oriented in a lateral*

direction perpendicular to a longitudinal direction and a fiber axis describing one quarter of a circular arc between a first end and the second end." Thus, while the Examiner has acknowledged that features **(2)-(3)** are not disclosed by the Matsuda reference, the Examiner has alleged that these features are taught by the Brownlow reference.

However, the Applicant respectfully disagrees with the Examiner's allegation and submits that the Brownlow reference fails to disclose, suggest, or render obvious the aforementioned features **(2)-(3)** of the present application.

It is initially emphasized that the Brownlow reference, unlike the present invention, is directed towards a method and apparatus for writing Bragg gratings on strained optical fibers generally using two-point bending [see column 1 (lines 60-67)]. The particular manufacturing process is shown in Figure 1.

Particularly, the Examiner's attention is directed towards line 19 (column 2) - line 4 (column 3) with references to Figures 1 and 2 which describe the fiber Bragg grating manufacturing process in detail. It is particularly noted that, in step C of Figure 1, the optical fiber is bent into a U-shape as depicted in Figure 2. Next, in step D, a Bragg grating is written into the bent fiber.

Thus, the bending of the fiber occurs only during steps C and D shown in Figure 1 during the manufacturing process as clearly evident from column 2 (lines 66-67) where it is stated that, "As a final step shown in block E, the strain is then relaxed, permitting the fiber to contract..". The Applicant submits that, since the strain was applied by bending the fiber as described earlier and in column 2 (lines 44-54), relaxing of the strain can be presumed to entail a reduction or removal of the bend. Moreover, as shown in Figure 2, the fiber Bragg grating 29 is formed in a short segment of the bent part of the fiber and the total bend in this short segment is quite minimal. As a result, when the bend is reduced or removed to relax the strain, the fiber Bragg grating would become substantially straight.

Since Figure 1 depicts the manufacturing process and since the last step in the process is step E (Relax Fiber), it is quite evident that the fiber Bragg grating of the Brownlow invention would not be used in the bent configuration shown in Figure 2. This is further supported by the fact that the

advantages recited in column 3 (lines 2-4) would not be obtained if the bent configuration shown in Figure 2 was used.

Thus, based on the foregoing, it is submitted that it is quite clear that the resultant fiber bragg grating of the Brownlow manufacturing process clearly fails to disclose or suggest the above-recited features **(2) and (3)** of the present application.

Morever, even assuming arguendo that the fiber Bragg grating of the Brownlow invention is used in the bent state depicted in Figure 2, it is submitted that the aforementioned features **(2) and (3)** are not disclosed or suggested by the fiber Bragg grating as depicted in Figure 2 since it is very evident that the two ends of the fiber Bragg grating 29 shown in Figure 2 are not oriented in mutually perpendicular directions and since it is very evident that the fiber axis of the fiber Bragg grating shown in Figure 2 is much less than a quarter of a circular arc.

Thus, the Applicant submits that the Matsuda and Brownlow references, taken ether alone or in combination, fail to disclose, suggest, or render obvious a fiber Bragg grating having **(2)** a first end oriented in the longitudinal direction, a second end oriented in a lateral direction perpendicular to the longitudinal direction, and **(3)** a fiber axis describing one quarter of a circular arc between the first end and the second end, as particularly claimed in independent claim 1 of the present application.

Moreover, it is submitted that the Matsuda and Brownlow references, taken ether alone or in combination, fail to disclose, suggest, or render obvious the features particularly claimed in each of newly added dependent claims 9-12 of the present application.

Particularly, the Applicant submits that the Matsuda and Brownlow references, taken ether alone or in combination, fail to disclose, suggest, or render obvious the first end and second end of said fiber Bragg grating as being oriented at right angles to one another, as now claimed in newly added dependent claim 9 of the present application.

Moreover, the Applicant submits that the Matsuda and Brownlow references, taken ether alone or in combination, fail to disclose, suggest, or render obvious that, when the stress is received in the longitudinal direction of the fiber Bragg grating strain sensor, the first end of the fiber Bragg grating becomes elongated and the second end of the fiber Bragg grating becomes compressed, as now claimed in newly added dependent claim 10 of the present application.

For at least the foregoing reasons, it is strongly submitted that claims 1-12 clearly are allowable.

Accordingly, it is strongly submitted that the present application now in fact clearly is in condition for allowance and the Examiner therefore is requested to pass this case to issue.

In the event however that the Examiner has any comments or suggestions of a nature necessary to place this case in condition for allowance, then the Examiner is requested to contact Applicants' undersigned attorney by telephone to promptly resolve any such matters.

Respectfully submitted,

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